SATLOC®

LiteStar III

User Guide

Part No. 875-0347-000 Rev A1

AgJunction®

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

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6549091	7400294	8085196	8311696	8718874	
6711501	7400956	8102325	8334804	8768558	
6744404	7429952	8138970	8489291	8781685	
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Chapter 1: Introduction

GPS vs. DGPS

What Can I Do with LiteStar III?

What's in this Guide?

LiteStar III is Satloc's powerful entry-level guidance system for aerial applicators. With an intuitive controller and lightbar, LiteStar III will simplify and improve all types of spraying applications resulting in less fatigue and improved safety.

GPS vs. DGPS

GPS (Global Positioning System) is a system of U.S. satellites that provides positioning data. Russia's GLONASS is another system. GPS has come to mean a general term of satellite positioning technology around the world, so this manual uses GPS in this manner. GPS accuracy can be affected by atmospheric interference, timing errors, and satellite orbit errors.

Differential GPS (DGPS) is GPS with an additional correction signal that improves GPS accuracy. Your LiteStar III system supports the following two DGPS technologies:

- WAAS (free service)

  WAAS (Wide Area Augmentation System) is the North American version of an SBAS system, a satellite-based service that provides differential corrections for users of standard GPS systems. Similar SBAS systems exist in Europe (EGNOS), India (GAGAN), and China (EGNOS). SBAS systems use GPS data from a network of reference stations spanning a wide geographic area to compute corrections and provide more accurate positioning.

- e-Dif (subscription-based service)

  Hemisphere GNSS' e-Dif (extended-Differential) technology provides precision guidance without using a broadcast differential signal. Requiring a lock on a minimum of four satellites, e-Dif typically maintains less than a 3 foot drift over 40 minutes in relation to your original reference point. Because it does use a broadcast differential signal, you can use e-Dif anywhere in the world—this makes e-Dif an ideal solution in areas where SBAS is unavailable or unreliable.

What Can I Do with LiteStar III?

LiteStar III provides guidance in flying and spraying your field. You select a pattern to fly along with other setup options and LiteStar III guides you along each row (or swath) in your pattern. The pattern and all other setup options you select comprise a job. Each time you use LiteStar III you can fly the most recent job (if you fly the same field each time) or start a new job.

What's in this Guide?

This user guide provides the following information:

- Chapter 2, "System Overview and Setup" describes how to power your system on and off and use the controller and lightbar to set up your system.
- Chapter 3, "Flying Patterns" covers the types of patterns, how to fly patterns, and setting and returning to a navigation mark.
- Chapter 4, "Viewing GPS Data and Using e-Dif" describes how to use Hemisphere GNSS' e-Dif technology.
- Appendix "Additional Information" answers frequently asked questions and lists technical specifications of your LiteStar III system.

Chapter 2: System Overview and Setup

System Components
Powering the System On and Off
Components Overview
Two Modes - Setup and Guidance
Setting Up Your System
Setting Job Related Options

System Components

Figure 2-1 shows the components of the LiteStar III system (cabling and installation hardware not shown).

Figure 2-1: LiteStar III components

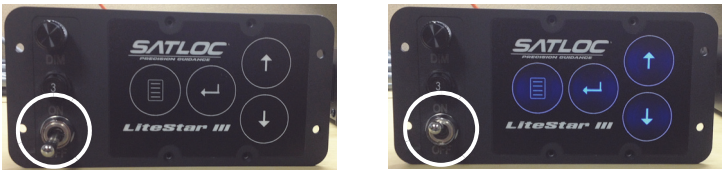
Powering the System On and Off

Before using LiteStar III, you need to know how to power the system on and off.

Powering On the LiteStar III

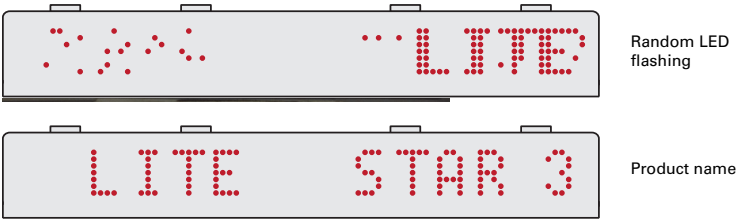
Before powering on the LiteStar III make sure your power source is uninterrupted and your system is well grounded.

To power on the LiteStar III, flip the console toggle switch up into the ON position.



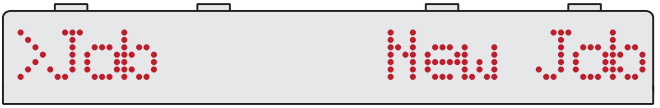
Upon startup the following occur:

- Controller buttons are illuminated blue (see above right)
- Lightbar performs its startup sequence (random LED flashing followed by the product name)



- If this is the first time you are powering on your LiteStar III or you have yet to start a job, the first Main menu item (SWidth, with the default setting) appears—continue with the rest of this chapter.

If you previously started a job, Job (New Job) appears. See “Starting a New Job” on page 18 for more information.



Powering Off the LiteStar III

Power off the LiteStar III *before* turning off the aircraft or main power source to ensure your data is saved.

To power off the LiteStar III, flip the console toggle switch down into the OFF position. The lightbar and controller go dark.

Components Overview

This section provides a brief overview of the each system component (including the joystick cabling).

Controller

Use the controller, mounted inside the cab within reach, to perform such tasks as powering your system on/off, setting options such as swath width and local time, and adjusting lightbar brightness. Figure 2-2 shows the functions of the controller’s buttons and controls and Table 2-1 on page 6 provides detailed information on these functions.

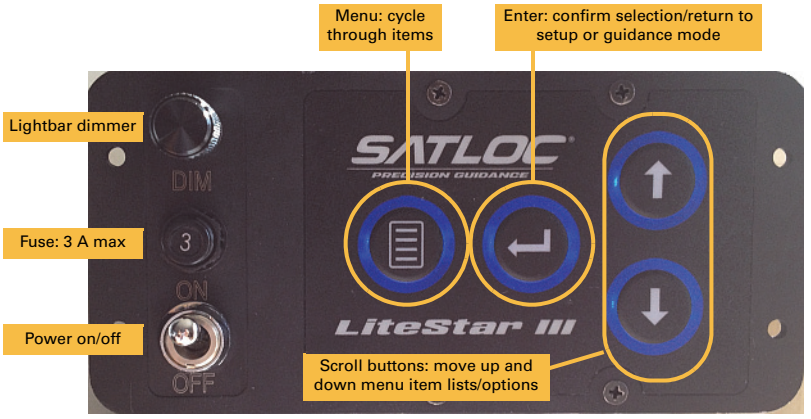


Figure 2-2: Controller functions

Table 2-1: Controller button and control descriptions

Button/Control	Function
Lightbar dimmer (DIM knob)	Rotate clockwise/counterclockwise to increase/decrease lightbar brightness.
Fuse	Protection fuse against any power surges from the aircraft.
Power switch	Flip up /down to power on/off the system.
Menu button	Switch to setup mode from guidance mode (see "Two Modes - Setup and Guidance" on page 7) or cycle through menu items.
Enter button	Confirm menu item selection or switch to guidance mode from setup mode (only after you set/confirm swath width and pattern).
Scroll buttons	Move up and down menu item lists/options.

Lightbar

The lightbar, mounted on the front of the aircraft (outside the cockpit but in clear view of the operator) displays all the information needed for guidance, such as crosstrack distance, GPS status, speed, heading, and navigation cues.

The LEDs on the lightbar are separated into sections (Figure 2-5):

- Upper LED bars show crosstrack distance and direction to the target swath.
- Lower LED bars show the heading (angle of intercept) to your target swath.
- Center LED column shows target swath alignment or warning cues (see "Troubleshooting" on page 25).
- Display fields (Disp 1-4) are user-defined and display such parameters as speed, heading, and sprayed area.

See "Setting Lightbar Options" on page 11 for general lightbar information, "Setting the Lightbar Display Fields" on page 14 for instructions on setting what appears in the four display fields, and "Flying a Basic Pattern" on page 21 for a detailed example of what the lightbar displays at different stages of flying a pattern.

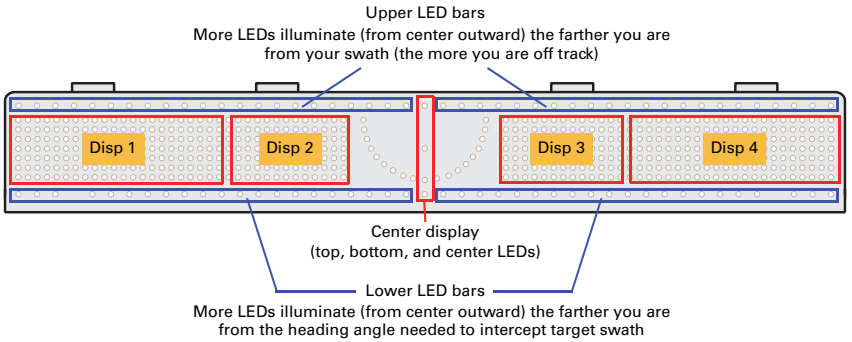

Upper LED bars
More LEDs illuminate (from center outward) the farther you are from your swath (the more you are off track)
Disp 1
Disp 2
Disp 3
Disp 4
Center display
(top, bottom, and center LEDs)
Lower LED bars
More LEDs illuminate (from center outward) the farther you are from the heading angle needed to intercept target swath

Figure 2-3: Lightbar sections

Cockpit Joystick Connections

LiteStar III includes a set of wires you can connect to the joystick in your cockpit.

Table 2-2: Joystick cabling functions

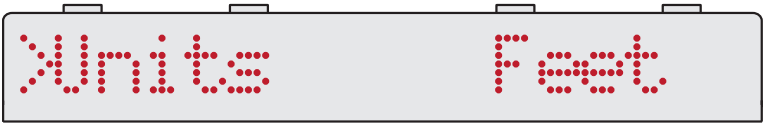
Cable/Wire	Function
SPRAY ON/OFF	Turn spray recording on or off (does not turn spray on or off) for use in area calculations. See “Area” description in Table 2-5 on page 15.
SWATH ADVANCE	Set pattern points (A, B, and optionally C) during pattern setup and receive guidance to next swath when in guidance mode.
SWATH DECREMENT	Decrement to a previous swath.
MANUAL MARK	Set (‘mark’) a location as a navigation mark or a mark to which you want to return.

Two Modes - Setup and Guidance

There are two modes in LiteStar III: setup mode and guidance mode.

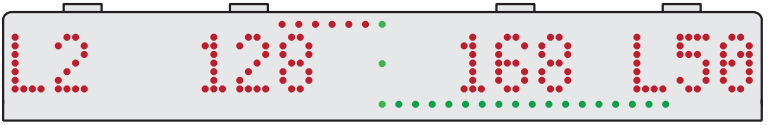
- Setup mode refers to using the controller to navigate the menu system to select options that appear on the lightbar.You can set such options as swath width, pattern, local time, and lightbar field displays. See “Controller” on page 5 for an overview of the controller and “Menu Overview” on page 8 for information on what you can set using the menu.

  The figure below shows the lightbar in setup mode (Units menu option).



- Guidance mode refers to using the four cable wires (typically connected to your cockpit joystick) to set your pattern points (A, B, and optionally C), and flying your pattern. The lightbar shows your status while flying your pattern and actively spraying a field.

  The figure below shows the lightbar in guidance mode.



The options you enter in setup mode are saved with the current job. Some options (such as units, local time, and differential type) you may set only once for all jobs. However, you may set other options (such as swath width and pattern) more often depending on the field.

Menu Overview

When you power on your system the lightbar displays its startup sequence followed by one of the following (see "Powering On the LiteStar III" on page 4):

- Main menu (shown at right)
- New Job (if you previously flew a pattern)

Main	
>SWidth	50.0
>Patrn	BK_BK R
>Dim	UseKnob
>Disp 1	SwthNum
>Disp 2	Speed
>Disp 3	AcftHdg
>Disp 4	X-Track
>LBar	Sens 2
>GPS	Menu
>UTC	0:00
>Units	Feet
>DifTyp	WAAS
>SBASR	Off
>SetFac	Defalts
DefsNOT	Reset

The Main menu has 14 options—the last item shown at right is not an option you can set (it indicates you did not reset factory defaults on the previous menu option).

You can set all the options (or leave the defaults), but LiteStar III requires you to set only the swath width and pattern before providing guidance—this way, pilots do not have to scroll through the entire menu to restart a job. Because these two options are required for guidance, each time you start a new job you are returned to the first option on the Main menu—SWidth (swath width).

Figure 2-4 below shows the complete menu structure for LiteStar III.

Tip! *Satloc recommends that you become comfortable navigating the menu before flying your first pattern.*

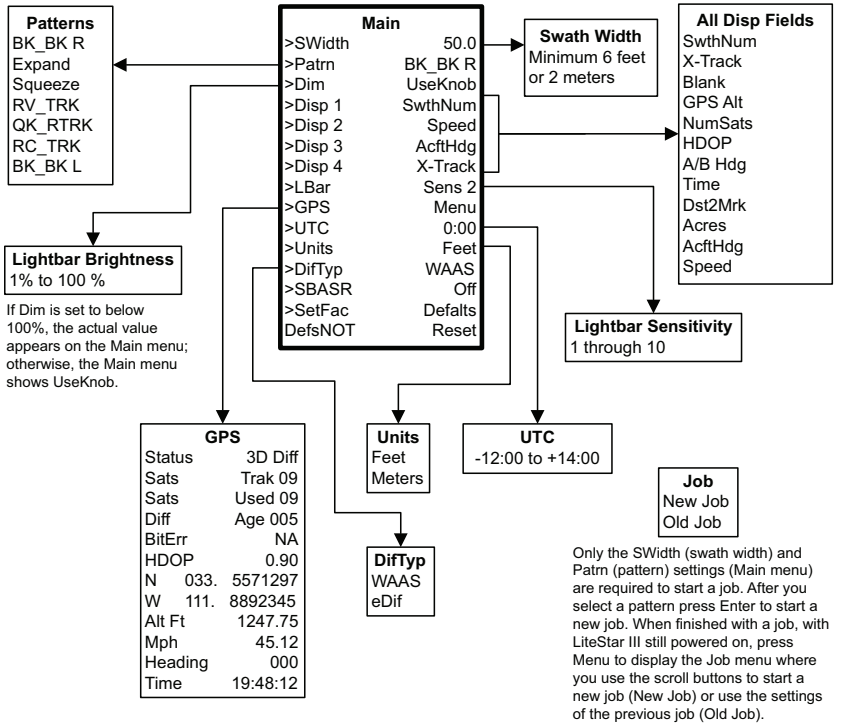
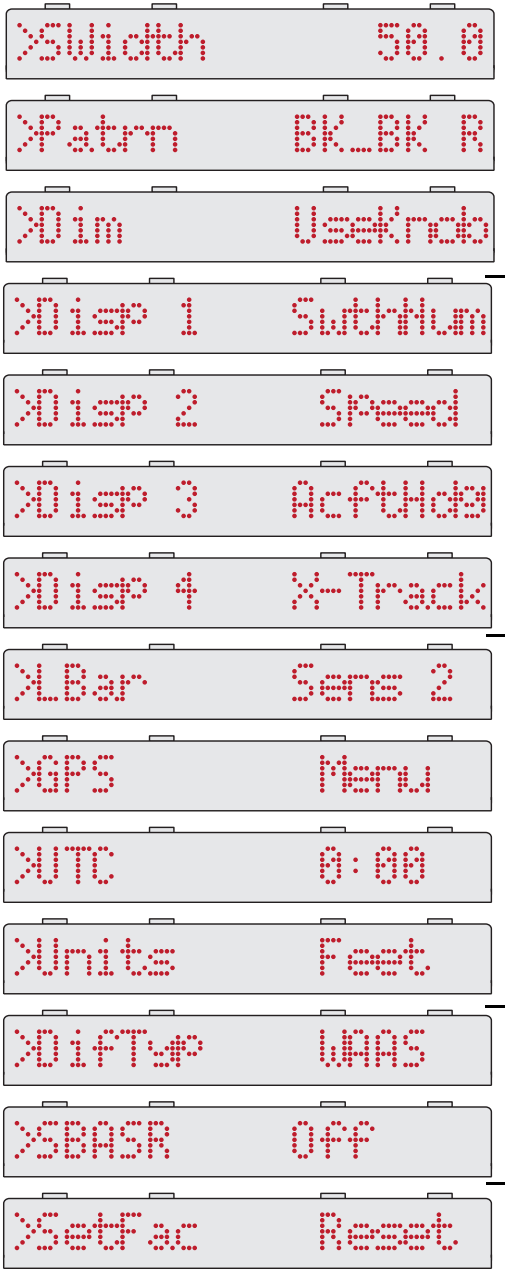


Figure 2-4: LiteStar III menu map

Main Menu Sequence

The figures below show the sequence of Main menu options. The first time you power on LiteStar III or each time you start a new job, the SWidth menu item appears. Each time you press the Menu button the next item in the sequence appears (from top bottom as shown below).



See "Setting the Swath Width" on page 17.

See "Setting the Pattern" on page 18, "Pattern Types Summary" on page 26, and "Flying the Available Pattern Types" on page 27.

See "Setting the Lightbar Brightness" on page 11.

See "Setting the Lightbar Display Fields" on page 14.

See "Setting the Crosstrack Sensitivity" on page 13.

See "Viewing GPS Data" on page 38.

See "Setting the UTC Offset" on page 11.

See "Setting the Units of Measurement" on page 10.

See "Selecting a Differential Corrections Source" on page 16.

See "Selecting a Differential Corrections Source" on page 16.

Setting Up Your System

LiteStar III is shipped with default factory settings. While the default settings are suitable for many users, you can change the following settings as needed.

- Units of measurement
- UTC offset (ensures correct local time)
- Lightbar brightness, crosstrack, sensitivity, and display field values
- Restore factory defaults

Once you finalize your settings you can fly patterns using LiteStar III.

Setting the Units of Measurement

By default, units are set to feet. To use metric units, you will need to change this setting.

To set the units of measurement:

1. Press the Menu button until Units appears, showing the current setting (Feet below).

2. Press either Scroll Up or Scroll Down to select the other units option.

   The example below shows Meters as the new units selection.

Setting the UTC Offset

Coordinated Universal Time (UTC) is similar to, but more precise than, Greenwich Mean Time (GMT). UTC is the time zone from which all other time zones are calculated and these time zones range from -12:00 (hours) to +14:00 (hours)—referred to as the UTC offset. Negative numbers increase as you move farther west from UTC; positive numbers increase as you move farther east from UTC. For example, the time zone for Dallas, Texas (USA) is -6:00.

Set the UTC offset to display the correct time for your system—this is the Time value on the GPS menu. See "Viewing GPS Data" on page 38 for more information on the GPS menu.

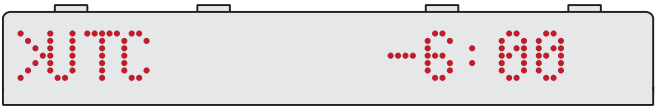
Note: If you live in an area that observes daylight savings (DST), set the UTC offset in LiteStar III twice a year.

To set the local time (UTC offset):

1. Press the Menu button until UTC appears.

2. Using the Scroll buttons repeatedly as needed, select the appropriate UTC offset—press Scroll Up to select a positive UTC offset or press Scroll Down to select a negative UTC offset.

The example below shows the UTC offset for Dallas, Texas (USA).



Setting Lightbar Options

LiteStar III enables to set lightbar brightness, sensitivity, and display fields.

Setting the Lightbar Brightness

Under certain conditions you may want to adjust the lightbar brightness. LiteStar III provides two methods (below) to adjust the brightness.

Using the Dim setting on the Main menu

Using the DIM knob

Use the table below to determine how and when to use the menu or the knob.

Table 2-3: Lightbar brightness options

Setting	Menu	Knob
UseKnob (default)	Press Scroll Down button to display 100%, then use either Scroll button to adjust level	Use knob to adjust level
1% to 100%	Use either Scroll button to adjust level	Cannot use knob until you press the Scroll Up button to set level to 100% then press Scroll Up again to display UseKnob

To set the lightbar brightness:

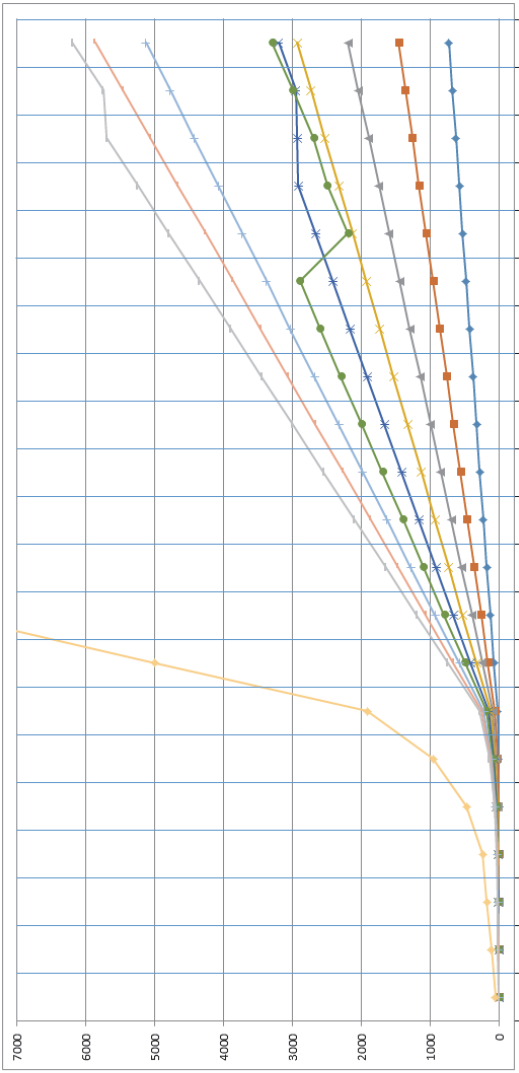
1. If using LiteStar III for the first time, you can use the knob to adjust the brightness. After that, any time you use LiteStar III, if you turn the knob and nothing happens then Dim is set anywhere from 1% to 100%. Proceed to step 2 to verify the level and set the brightness.
2. Press the Menu button until Dim appears, showing the current setting (UseKnob below).

Use Table 2-3 above to set the brightness. The example below shows the lightbar brightness set to 20% using the menu.

Note: You can use the knob to set the lightbar brightness to a similar level to any level you set using the menu; however, the lightbar will always display 'UseKnob' when using the knob with the Dim setting visible.

Setting the Crosstrack Sensitivity

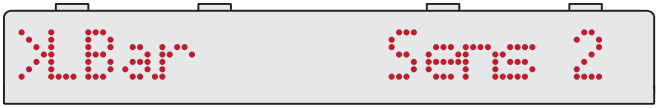
Crosstrack (X-Track) is the perpendicular distance from your swath line. Crosstrack sensitivity refers to the relationship between how far you are from your swath line and how this distance is represented by the upper LED bars on the lightbar (shown below). The default crosstrack sensitivity is 3 feet per LED, where the first LED illuminates when the crosstrack distance reaches 3 feet, the second LED illuminates when the distance reaches 6 feet, and so forth. There are 21 settings; one for each LED. You can change any of the values. To reset all the values to their defaults, press Default.



Sensitivity Level	LED 1	LED 2	LED 3	LED 4	LED 5	LED 6	LED 7	LED 8	LED 9	LED 10	LED 11	LED 12	LED 13	LED 14	LED 15	LED 16	LED 17	LED 18	LED 19	LED 20	LED 21
1	1	2	3	4	8	16	32	83	133	183	233	283	333	383	433	483	533	583	633	683	733
2	2	4	6	8	16	32	64	167	267	367	467	567	667	767	867	966	1066	1166	1266	1366	1466
3	3	6	9	12	24	48	96	250	400	550	700	850	1000	1150	1300	1450	1600	1750	1900	2050	2200
4	4	8	12	16	32	64	128	333	533	733	933	1133	1333	1533	1733	1933	2133	2333	2533	2733	2933
5	5	10	15	20	40	80	160	417	667	917	1167	1417	1667	1917	2167	2416	2666	2916	2936	2956	3206
6	6	12	18	24	48	96	192	500	800	1100	1400	1700	2000	2300	2600	2900	2200	2500	2700	3000	3300
7	7	14	21	28	56	112	224	583	933	1283	1633	1983	2333	2683	3033	3383	3733	4083	4433	4783	5133
8	8	16	24	32	64	128	256	667	1067	1467	1867	2267	2667	3067	3467	3866	4266	4666	5066	5466	5866
9	9	18	27	36	72	144	288	750	1200	1650	2100	2550	3000	3450	3900	4350	4800	5250	5700	5750	6200
10	60	120	180	240	480	960	1920	5000	8000	11000	14000	17000	20000	23000	26000	29000	32000	35000	38000	41000	44000

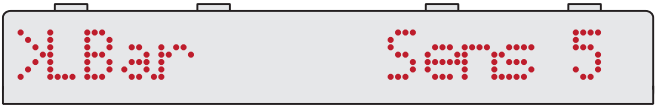
To set the crosstrack sensitivity:

1. Press the Menu button until LBar appears.



2. Using the Scroll buttons repeatedly as needed, select the appropriate sensitivity level—press Scroll Up to increase the level or press Scroll Down to decrease the level.

   The example below shows the sensitivity set to level 5.



Setting the Lightbar Display Fields

The lightbar includes four user-defined fields (Disp 1-4) that can display such parameters as speed, heading, and sprayed area. See Table 2-4 for a list of available options for display in each field and Table 2-5 on the next page for a description of each display field option.

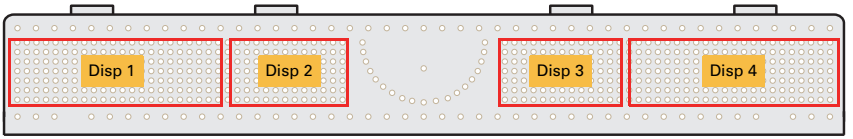


Figure 2-5: Lightbar display fields (four)

Table 2-4: Lightbar display fields order of menu items

Disp 1	Disp 2	Disp 3	Disp 4
SwthNum	SwthNum	SwthNum	SwthNum
X-Track	Blank	Blank	**X-Track**
Blank	NumSats	NumSats	Blank
GPS Alt	HDOP	HDOP	GPS Alt
NumSats	A/B Hdg	A/B Hdg	NumSats
HDOP	Time	Time	HDOP
A/B Hdg	Acres or Hectare	Acres or Hectare	A/B Hdg
Time	AcftHdg	**AcftHdg**	Time
Dst2Mrk	**Speed**	Speed	Dst2Mrk
Acres or Hectare			Acres or Hectare
AcftHdg			AcftHdg
Speed			Speed
Note: X-Track, GPS Alt, and Dst2Mrk are available for display only in the far left (Disp 1) and far right (Disp 4) fields. Bold items above indicate defaults values.			

Table 2-5: Display field menu item descriptions

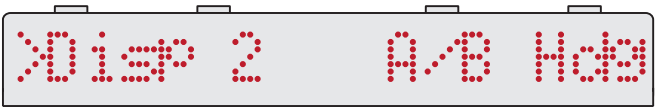
Item	Description
SwthNum	Current swath number
X-Track	Crosstrack distance (see "Setting the Crosstrack Sensitivity" on page 13)
Blank	Nothing appears in the display field
GPS Alt	Aircraft altitude
NumSats	Number of tracked satellites
HDOP	Horizontal dilution of precision, a numeric value expressing the confidence factor of the position solution based on current satellite geometry (the lower the HDOP value, the greater the confidence level)
A/B Hdg	Heading angle of A|B line
Time	Local time (see "Setting the UTC Offset" on page 11)
Dst2Mrk	Distance to mark (see "Using Navigation Marks" on page 34)
Acres or Hectare	Sprayed area (when SPRAY is on), in acres or hectares See "Cockpit Joystick Connections" on page 7 for information on the SPRAY ON/OFF wire.
AcftHdg	Heading angle of aircraft, where heading is the direction from True North—North is 0°/360°; South 180°
Speed	Aircraft speed

To set a display field:

1. Press the Menu button until the preferred display field appears (Disp 2 shown below).

2. Press Scroll Up or Scroll Down until you see the desired display menu item.

   The example below shows the Disp 2 field set to A|B heading.



Selecting a Differential Corrections Source

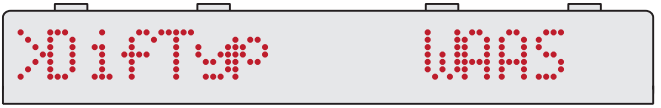
You have two differential corrections options for LiteStar III: WAAS and e-Dif.

- WAAS—Wide Area Augmentation System that covers all of North America (this is the default selection in LiteStar III)
- e-Dif—extended Differential system developed by Hemisphere GNSS that uses internally generated differential corrections to enable you to achieve differential accuracy where there is no SBAS coverage or where differential coverage is unreliable

When you select the other differential source, allow enough time for the system to adjust—this may take several minutes, similar to how long it may take at startup.

To select a differential corrections source:

1. Press the Menu button until DifTyp appears, showing the current setting (WAAS below).

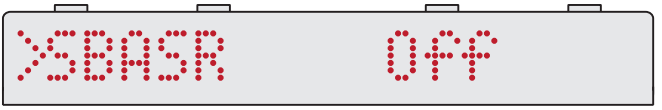


2. Press either Scroll Up or Scroll Down to select the other differential corrections option.

   The example below shows e-Dif as the new differential corrections selection.

3. (Optional) Press the Menu button to display SBASR, then press either Scroll Up or Scroll Down to set SBASR to On or Off.

   - For areas where WAAS corrections are limited, set to Off.
   - For areas where WAAS corrections are available, set to On to receive the differential part of the signal.



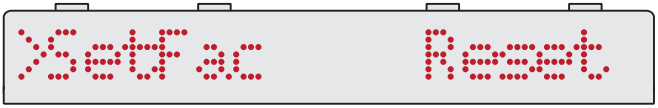
Restoring Factory Default Settings

Factory defaults are the preprogrammed setup options that enable you to begin using LiteStar III right after installation. If you change any settings, you can quickly restore your system to its factory default settings.

To reset factory defaults settings:

1. Press the Menu button until SetFac appears.

2. Press Enter. Reset appears briefly in place of Defalts...



...then after the reset process is complete SWidth (first Main menu item) appears.

Setting Job Related Options

All setup options have a default value. The first time you use LiteStar III you must verify/select a swath width and pattern before you can switch to guidance mode (all other options in setup mode are optional). For each subsequent new job, you still must verify/set only the swath width and pattern—see “Starting a New Job” on page 18 and “Starting a New Job While in an Active Job” on page 33.

If necessary, you can restore setup options to their factory default values (see “Selecting a Differential Corrections Source” on page 16).

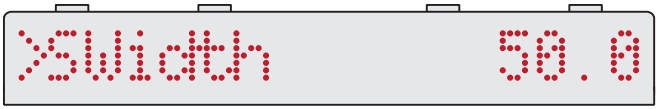
Setting the Swath Width

A swath is a row in an area you want to spray. LiteStar III uses your swath width to calculate and provide guidance to subsequent swaths in a selected pattern.

Note: When starting a new job, you must verify/set the swath width (and the pattern) before switching to guidance mode.

To set the swath width:

1. Press the Menu button until SWidth appears. When starting a new job, SWidth appears as the first setup option.



2. Using the Scroll buttons repeatedly as needed, set the swath width—press Scroll Up to increase the value or press Scroll Down to decrease the value.

   The example below shows the swath width set to 35.0.

Setting the Pattern

LiteStar III includes seven pattern types.

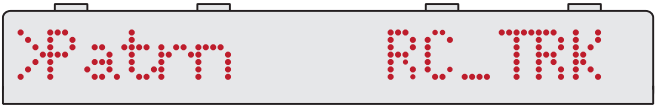
Note: When starting a new job, you must verify/set the swath width (and the pattern) before switching to guidance mode.

To set the pattern type:

1. Press the Menu button until Patrn appears.

2. Press either Scroll Up or Scroll Down to select a different pattern.

   The example below shows racetrack (RC_TRK) as the new pattern selection.



Starting a New Job

To start a new job on powerup (first time, without ever creating a job):

1. Set your setup mode options. Only swath width (SWidth) and pattern (Patrn) are required to start a job—see "Setting Job Related Options" on page 17. To set system options see "Setting Up Your System" on page 10.
2. Press Enter to enter guidance mode. LiteStar III prompts you to set the A point of your pattern as shown in the example below.

To start a new job on powerup (after previously flying a job):

1. Press Enter to enter setup mode.
2. Perform the two steps above for starting a new job on powerup (first time).

Chapter 3: Flying Patterns

Patterns Overview
Flying a Basic Pattern
Pattern Types Summary
Flying the Available Pattern Types
Additional Job Tasks
Using Navigation Marks

This chapter describes patterns (types and how you set them and fly them), job tasks, and marks (return points).

Patterns Overview

You can fly two types of patterns using LiteStar III:

- Open pattern—where you can fly an unlimited (open) number of swaths because the pattern is independent of the size of the field
- Closed pattern—where the number of swaths you can fly is limited (closed) because you define the width of the field

Both open and closed patterns require an initial guideline on which to base the pattern's GPS coordinates. In LiteStar III, this initial guideline is called the A|B line (a straight line defined by two points A and B). Closed patterns need an additional defined point—point C.

Table 3-1 describes how A|B lines are used in open and closed patterns.

Table 3-1: A|B lines in open and closed patterns

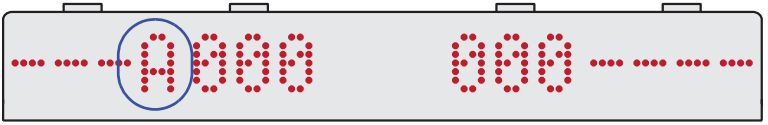
Pattern	A|B Line Use
Open	Point A is the beginning of the line Point B is the end of the line All swaths you fly will be parallel to this initial A|B line LiteStar III prompts you to set your A and B points according to the pattern you select. The A|B line may be inside or outside the field. Points A and B should be as far apart as possible to ensure the accuracy of the line. Establishing A and B points too close together may result in a small error that creates a larger divergence the longer the distance.
Closed	Point A is the beginning of the line Point B is the end of the line You define the width of your field by setting a third point—C LiteStar III prompts you to set your A, B, and when applicable, C points according to the pattern you select.

After setting up your system and job parameters (see Chapter 2, "System Overview and Setup") you are ready to begin flying a pattern (fly a job) with LiteStar III.

Flying a Basic Pattern

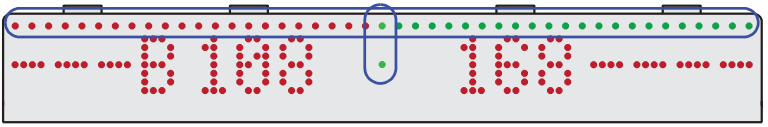
Complete the following steps to fly a basic pattern—the example below uses an open Back-to-Back Left pattern (BK_BK L) with default settings for the display fields: Disp 1 = swath width, Disp 2 = speed, Disp 3 = aircraft heading, Disp 4 = crosstrack.

1. Set up your job parameters and press Enter to switch to guidance mode—'A' appears in the Disp 1 field of the lightbar, prompting you to set point A of the A|B line. Begin flying.

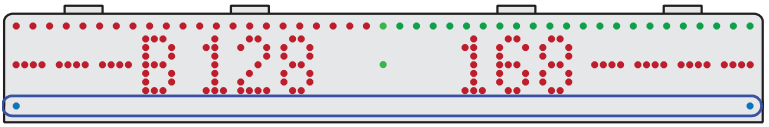


2. Fly to the beginning of your A|B line. As you fly Disp 2 shows your aircraft speed (085) and Disp 3 shows your aircraft heading (168).

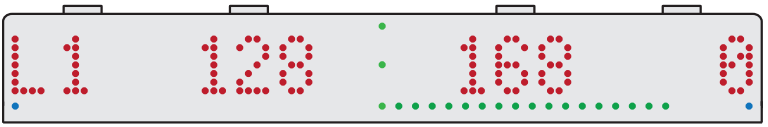
3. Press the remote swath advance button to set your A point. 'B' appears in the Disp 1 field, prompting you to set your B point. The upper row of LEDs (left side red, right side green) flashes continuously, while the center green LED is illuminated but not flashing.



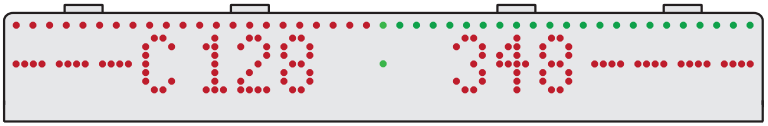
4. Turn on your spray as you enter the field. The far left and far right LEDs on the bottom row illuminate to indicate spraying is on (the top row of LEDs continues to flash and the center LED stays illuminated).



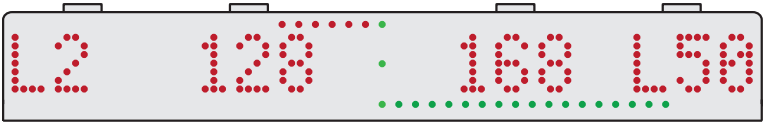
5. Press the remote swath advance button to set your B point. Disp 1 shows the pattern direction (L, left) and swath number (1) and Disp 4 shows the crosstrack (0).



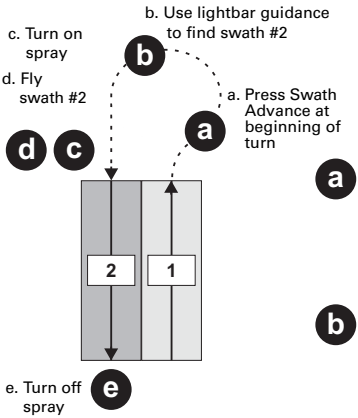
If you are flying a closed pattern, the lightbar next prompts you to set your C point. “C” appears in the Disp 1 field. Press the remote swath advance button to set your C point.



6. Turn off the spray as you leave the field. The two blue LEDs (far left and far right) are no longer illuminated.
7. Press the remote swath advance button to advance to swath #2. The lightbar indicates the following:
   - Disp 1 shows swath #2 is to the left
   - Disp 4 shows you need to go 50 ft to the left to get to swath #2 (50 ft is the crosstrack distance—the perpendicular distance off your swath line)
   - Upper row of LEDs shows the crosstrack distance in graphical terms (the more LEDs illuminated, the larger the crosstrack distance)
   - Lower row of LEDs shows the heading angle in graphical terms (the more LEDs illuminated, the larger the angle you need to turn—all LEDs illuminated indicates you need to turn a full 180°, what you would expect when you want to complete a subsequent swath).



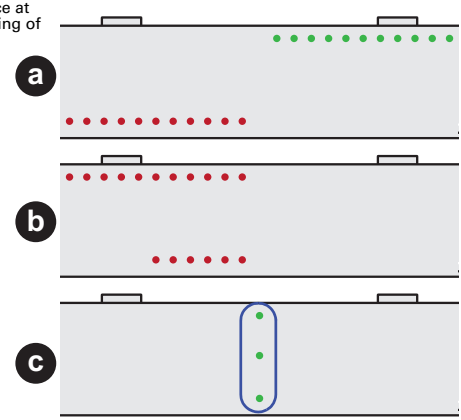
8. Make the turn to get onto swath #2 using the lightbar for guidance.



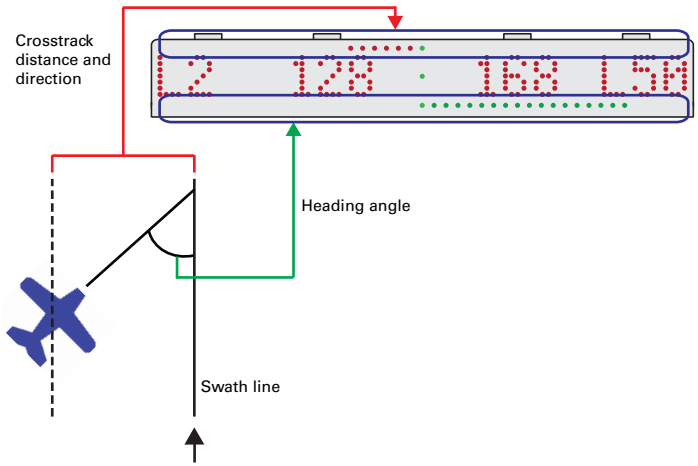
Lightbar guidance:
Top row of LEDs shows crosstrack distance and direction to the target swath.

Bottom row of LEDs shows the heading (angle of intercept) to the target swath.

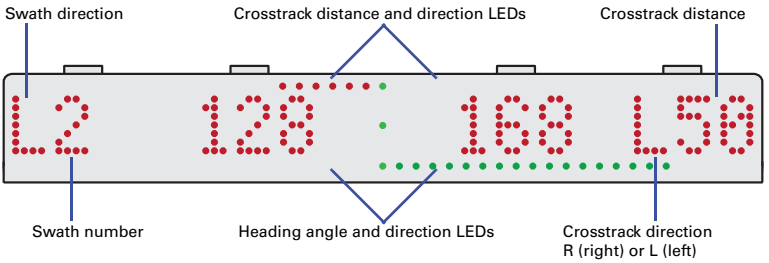
Center LEDs illuminated indicate you are lined up on the swath.



The top row of LEDs shows the distance and direction (right or left) you need to fly to get to the target swath line. The default right display tells you the exact crosstrack distance.



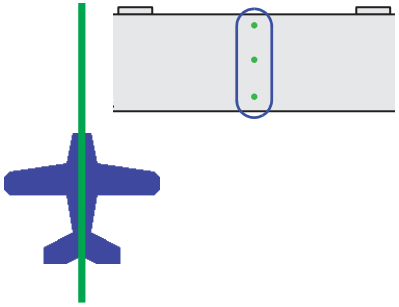
The bottom row of LEDs shows the heading angle needed to intercept the target swath line. The default left display tells you the current swath number.



Each LED represents a certain distance. For example:

- For crosstrack distance (top row of LEDs), the farther you are from your target swath, the more LEDs are illuminated. When you are closer to your target swath, fewer LEDs are illuminated.
- For heading angle, the farther you are from the required heading angle needed to intercept the target swath, the more LEDs are illuminated. When you are closer to your required heading angle, fewer LEDs are illuminated.

When the center vertical row of lightbar LEDs is illuminated, you are on the target swath (shown at right).



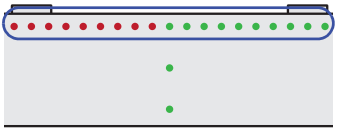
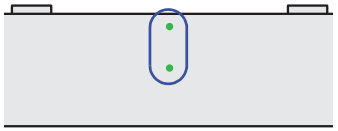
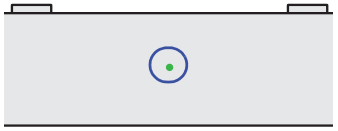
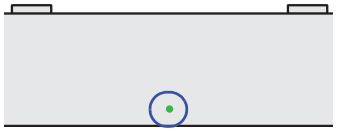
9. Turn the spray on as you enter the field then fly swath #2 using lightbar guidance.
10. Continue to fly your swaths using lightbar guidance.

Note: When you are finished flying a closed pattern the lightbar displays "DONE" and all guidance cues turn off (with the exception of the Quick Racetrack pattern, where the system switches to Back-to-Back guidance).

Troubleshooting

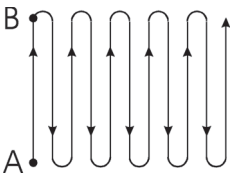
When flying a pattern, the lightbar may display such warnings as spraying a previously sprayed swath (double-spray warning) or invalid/poor DGPS reception. When LiteStar III generates a warning your active guidance display disappears from the lightbar. In its place you see flashing LEDs and/or additional error information in the Disp 1 and Disp 4 fields.

Table 3-2: Lightbar warnings

Lightbar Display	Warning Message
	Swath Double Spray Upper LED row flashes when spray on is detected on a previously sprayed swath. The flashing continues until the swath number is changed.
	Extrapolated GPS Top two center yellow LEDs blink. Reboot system (see “Powering the System On and Off” on page 4).
	DGPS Signal Lost Center yellow LED flashes and system will use extrapolated GPS signal from last signal. Reboot system (see “Powering the System On and Off” on page 4).
	Poor DOP (Dilution of Precision) Lower center yellow LED flashes. Check status lights on receiver. Reboot system (see “Powering the System On and Off” on page 4) and wait up to five minutes for a better solution.

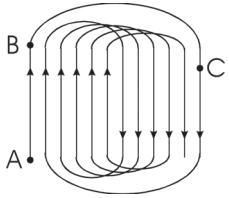
Pattern Types Summary

LiteStar III supports the following pattern types (both open and closed), providing the flexibility to fly any field shape. Although LiteStar III includes ten pattern types, you can store as many as 99 flown patterns in a job.



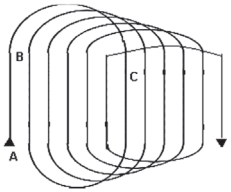
Back-to-Back Right (BK_BK R)
Back-to-Back Left (BK_BK L)

Fly consecutive swaths parallel to the A|B line, from left to right (BK_BK R, shown above) or from right to left (BK_BK L).



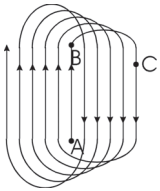
Racetrack (RC_TRK)

Fly each side of a field, then alternately work from swath #2 to the middle, and from the middle toward the other end of the field. This pattern is useful for flying wide, smooth turns.



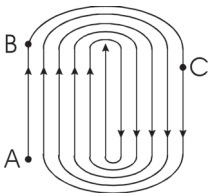
Quick Racetrack (QK_RTRK)

Fly a pattern similar to the Racetrack, but set your C point in the middle of the field.



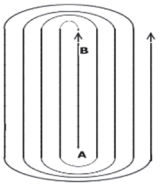
Reverse Racetrack (RV_TRK)

Fly a pattern similar to the Racetrack. This is called the “Reverse” Racetrack because you are flying in one direction, but swaths are incrementing in the opposite direction. In this pattern, you set your A|B line in the center of the field. This pattern is useful for flying circular fields or other fields where the center line is clearly visible.



Squeeze (Squeeze)

Fly loops of decreasing size, from the outside of the field to the middle of the field. This pattern allows you to make wide turns at the beginning of a job when carrying a heavy load, and narrower turns as your load becomes lighter.



Expand (Expand)

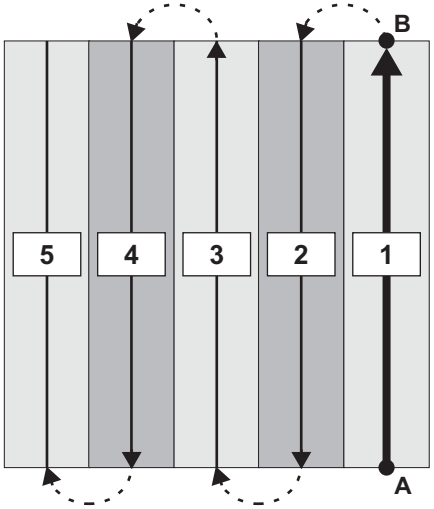
Fly successive swaths outward from the center of the field. This pattern is useful for fields with a visible center line or a long, irregular shape.

Flying the Available Pattern Types

This section reinforces the main points about each pattern and describes how to fly the patterns.

Back-to-Back Pattern (BK_BK)

In a Back-to-Back pattern you fly consecutive swaths parallel to the A|B line. You can fly this pattern either left-to-right (BK_BK R) or right-to-left (BK_BK L, shown below).



To fly a Back-to-Back pattern:

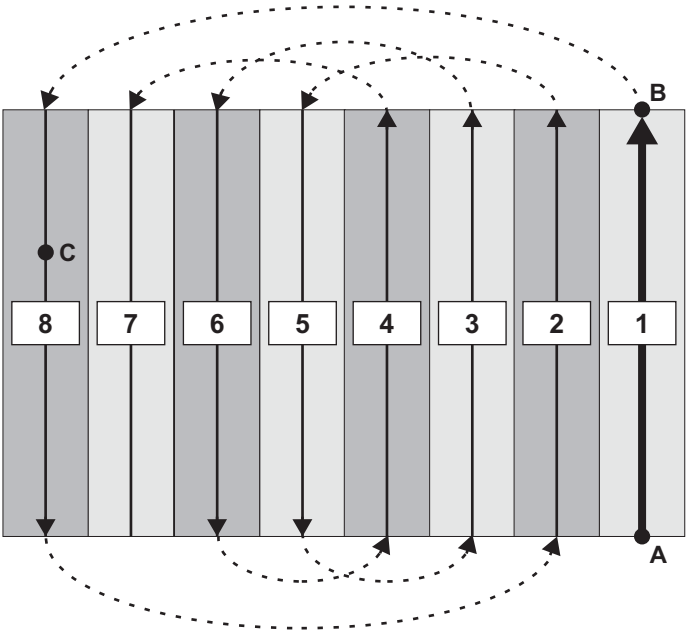
1. Set the swath width.
2. Set the pattern type as BK_BK R or BK_BK L.
3. Press Enter to begin guidance.

   or

   Press Menu to move to the next Main menu item and press Scroll Up or Scroll Down to set the value, repeat this step for each additional menu item you want to set, then press Enter to begin guidance.
4. Set your A|B line (see “Flying a Basic Pattern” on page 21).
5. Fly swaths consecutively: 1, 2, 3, etc.

Racetrack Pattern (RC_TRK)

The Racetrack pattern consists of a series of loops (or racetracks) resulting in wider, smoother turns. In this pattern, you first fly each side of a field, then alternately work from swath #2 to the middle, and from the middle toward the other end of the field.



To fly a Racetrack pattern:

1. Set the swath width.
2. Set the pattern type as RC_TRK.
3. Press Enter to begin guidance.

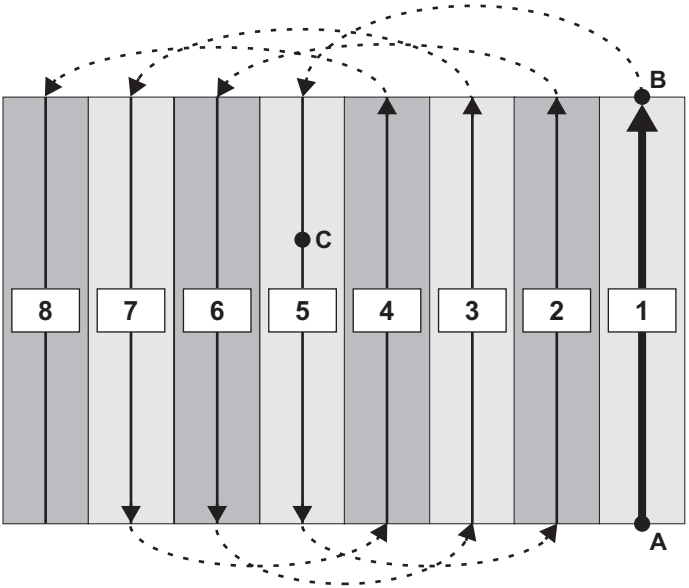
   or

   Press Menu to move to the next Main menu item and press Scroll Up or Scroll Down to set the value, repeat this step for each additional menu item you want to set, then press Enter to begin guidance.
4. Set your A|B line (see “Flying a Basic Pattern” on page 21).
5. Fly swaths in the following order: 1, 8, 2, 5, 3, 6, 4, 7.

Quick Racetrack Pattern (QK_RTRK)

The Quick Racetrack pattern is similar to the Racetrack pattern, but in this pattern you set your C point in the center of the field, not at the end. This is called a 'Quick' Racetrack because you do not have to fly to the end of the field to set the C point.

In the Quick Racetrack pattern you fly a constant size loop after setting the A, B, and C points. Point C is the swath on or after the field center line.



To fly a Quick Racetrack pattern:

1. Set the swath width.
2. Set the pattern type as QK_RTRK.
3. Press Enter to begin guidance.

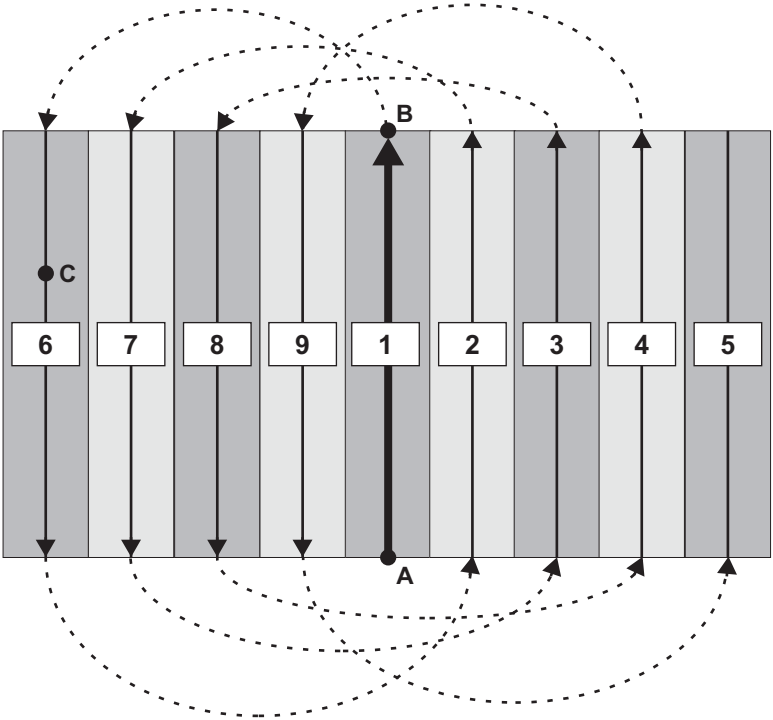
   or

   Press Menu to move to the next Main menu item and press Scroll Up or Scroll Down to set the value, repeat this step for each additional menu item you want to set, then press Enter to begin guidance.
4. Set your A, B, and C points (see "Flying a Basic Pattern" on page 21).
5. Fly swaths in the following sequence: 1, 5, 2, 6, 3, 7, 4, 8.

Reverse Racetrack Pattern (RV_TRK)

The Reverse Racetrack pattern is similar to the Racetrack pattern, but as you fly in one direction, the swaths increment in the opposite (reverse) direction. In the example below, as you fly to the left the swaths increment to the right.

Unlike the Racetrack pattern, in the Reverse Racetrack pattern, you set your A|B line in the middle of the field. Point C is still on the edge of the field. This pattern is recommended for circular fields or other fields where the center line is clearly visible.



To fly a Reverse Racetrack pattern:

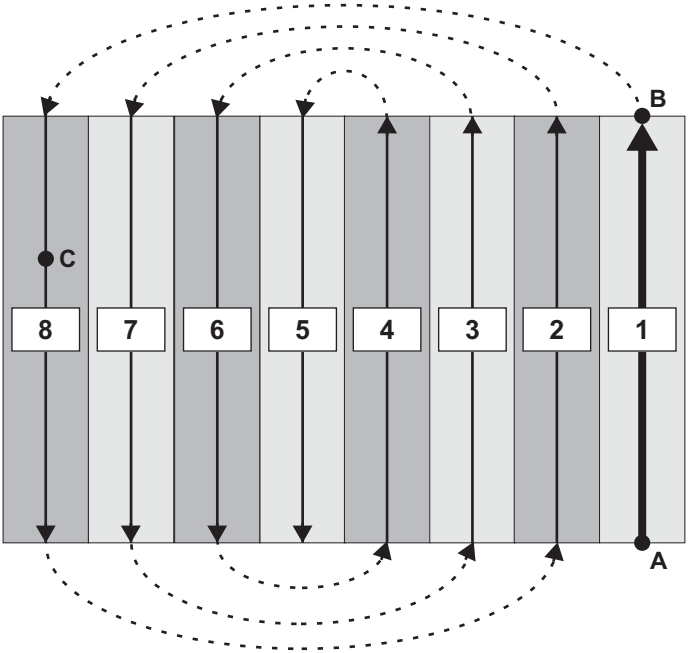
1. Set the swath width.
2. Set the pattern type as RV_TRK.
3. Press Enter to begin guidance.

   or

   Press Menu to move to the next Main menu item and press Scroll Up or Scroll Down to set the value, repeat this step for each additional menu item you want to set, then press Enter to begin guidance.
4. Set your A|B line (see "Flying a Basic Pattern" on page 21).
5. For a 9-swath *right reverse racetrack* pattern, spray the swaths in the following sequence: 1, 6, 2, 7, 3, 8, 4, 9, 5.

Squeeze Pattern (Squeeze)

The Squeeze pattern comprises loops of decreasing size, from the outside of the field to the middle of the field. You define the outside edges of your field (the largest loop) by your A|B|C points. You make wide turns at the beginning of your spray job when your load is heavy then make narrower turns as your load becomes lighter.



To fly a Squeeze pattern:

1. Set the swath width.
2. Set the pattern type as Squeeze.
3. Press Enter to begin guidance.

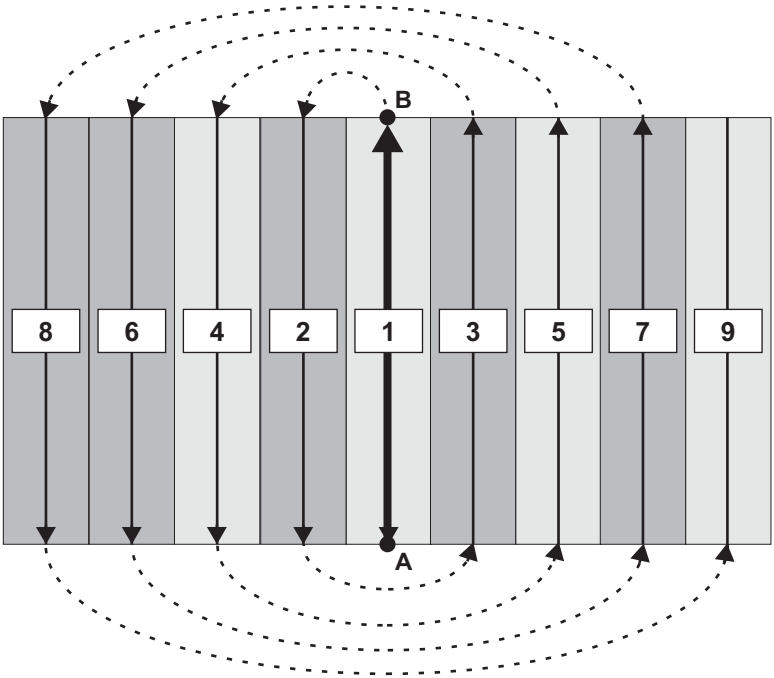
   or

   Press Menu to move to the next Main menu item and press Scroll Up or Scroll Down to set the value, repeat this step for each additional menu item you want to set, then press Enter to begin guidance.
4. Set your A|B line (see “Flying a Basic Pattern” on page 21).
5. For an 8-swath field, spray the swaths in the following sequence:

   1, 8, 2, 7, 3, 6, 4, 5

Expand Pattern (Expand)

The Expand pattern begins with the A|B line in the center of the field and successive swaths increase outward. Expand patterns are useful for fields with a visible center line or with a long, irregular shape. You can fly this pattern either right-to-left or left-to-right.



To fly an Expand pattern:

1. Set the swath width.
2. Set the pattern type as Expand.
3. Press Enter to begin guidance.

   or

   Press Menu to move to the next Main menu item and press Scroll Up or Scroll Down to set the value, repeat this step for each additional menu item you want to set, then press Enter to begin guidance.
4. Set your A|B line (see "Flying a Basic Pattern" on page 21).
5. For a 9-swath *Expand Left* pattern, spray the swaths in the following sequence:

   1, 2, 3, 4, 5, 6, 7, 8, 9

Additional Job Tasks

For instructins on starting a new job at powerup, see “Starting a New Job” on page 18.

This section describes the following additional job tasks that you can perfomin LiteStar III:

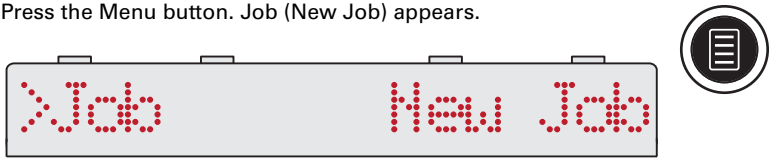
- Starting a new job while in an active job (with or without a mark set)
- Starting an old job on powerup

Starting a New Job While in an Active Job

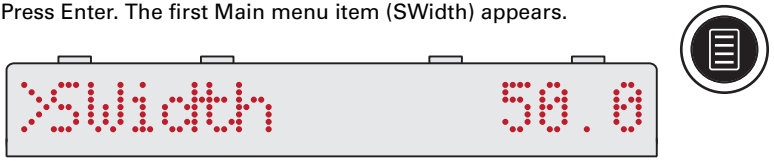
You can start a new job while currently in a job in guidance mode. The following two procedures differ according to whether you have set a mark in the current job. See “Using Navigation Marks” on page 34 for more inf ormation on marks. For the procedure where you have set a mark, you must first cancel guidance to the mark.

To start a new job while in an active job in guidance mode (no mark set):

1. Press the Menu button. Job (New Job) appears.



2. Press Enter. The first Main menu item (SWidth) appears.



3. Set your swath width and pattern then press Enter to switch to guidance mode.

   To set other options before entering guidance mode, repeat steps 2 and 3 for each option, then repeat step 4 to enter guidance mode.

To start a new job while in an active job in guidance mode (mark set):

1. Press MANUAL MARK (joystick). The Return to Mark menu appears.

2. Press Enter twice or SWATH ADVANCE (joystick) twice. LiteStar III cancels guidance to the mark and you return to normal guidance.
3. Perform the three steps above for starting a new job while in an active job in guidance mode (no mark set).

Starting an Old Job

LiteStar III enables you to start a job based on the previous job (using the same system and job settings). For example, you may want to fly the same job several times in a row.

You can start an old job at powerup—Job (New Job) appears if you have previously flown a job or you can start an old job while in guidance mode (for example, if you want to restart an old job without power cycling the system).

To start an old job on powerup:

1. Press either Scroll Up or Scroll Down to display Old Job.

2. Press Enter to enter guidance mode. LiteStar III prompts you to set the A point of your pattern as shown in the example below.

To start an old job while in guidance mode:

1. Press the Menu button. Job (New Job) appears.

2. Perform the two steps above for starting an old job on powerup.

Using Navigation Marks

In LiteStar III you can set a mark to return to later on.

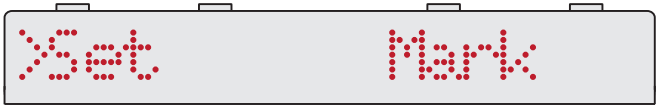
Setting a Mark

You can set one mark. Each time you set a mark or when you start a new job, LiteStar III deletes the previous mark.

A mark is a location you set that you want to fly back to—when you save a mark you are saving the GPS coordinates of that point.

To set a mark:

1. In guidance mode (thus, with an active job) press MANUAL MARK (joystick). The Set Mark menu appears.



2. Press MANUAL MARK again to set the GPS coordinates of the mark.
3. Press Enter or SWATH ADVANCE (joystick) to return to guidance mode.

Returning to a Mark

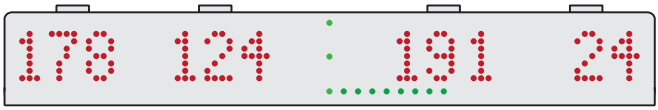
When you return to a mark, LiteStar III calculates the shortest distance between where you recalled the mark and the mark and provides guidance back to the mark.

To return to a mark:

1. Press MANUAL MARK (joystick). The Return to Mark menu appears.

2. Press Enter or SWATH ADVANCE (joystick). You return to guidance mode and LiteStar III provides guidance to the mark.

   The example below shows your distance to the mark in feet (Disp 4 = 24).



3. As you get closer to the mark, the distance-to-mark value (Disp 4) decreases; when you reach the mark, this value is zero and the lightbar LEDs that are currently illuminated flash brightly once.

Canceling Guidance to a Mark

When you cancel guidance to a mark , LiteStar III resumes normal guidance—providing guidance based on the pattern of your current (active) job.

To cancel to a mark:

1. Press MANUAL MARK (joystick). The Return to Mark menu appears.

2. Press Enter or SWATH ADVANCE (joystick) twice to return to guidance mode.

Chapter 4: Viewing GPS Data and Using e-Dif

Viewing GPS Data
Using e-Dif

Differential GPS (DGPS) is GPS with an additional correction signal that improves GPS accuracy—referred to as differential corrections. DGPS enables GPS users to achieve far greater accuracy than the GPS signal alone can provide. See "GPS vs. DGPS" on page 2 for more information on DGPS.

DGPS uses a reference station at a known point (or base station) to calculate and correct signal errors. The reference station computes corrections for each satellite signal and broadcasts these corrections to the remote (or field) GPS receiver. The remote receiver then applies the corrections to each satellite used to calculate its fix.

You can perform the following DGPS tasks:

- View GPS data
- Select the differential corrections source

Viewing GPS Data

The GPS menu provides access to the following read-only LiteStar III GPS information, with an example menu to the right of the bulleted list.

- Signal status—displays '3D Diff' to indicate a three-dimensional differentially corrected signal (if you do not have a DGPS signal, you cannot view the GPS menu).
- Number of satellites tracked and used (you need to track at least four satellites to obtain an accurate GPS position).
- BitErr: NA indicates field is for future use
- Differential age (in seconds)—time since last differential correction. If this value is zero, you are not receiving differential corrections.
- Horizontal dilution of precision (HDOP)—the lower the value the better the GPS precision.

GPS	
Status	3D Diff
Sats	Trak 09
Sats	Used 09
Diff	Age 005
BitErr	NA
HDOP	0.90
N 033.	5571297
W 111.	8892345
Alt Ft	1247.75
Mph	45.12
Heading	000
Time	19:48:12

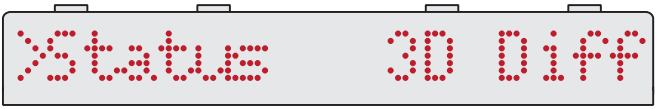
- Latitude, longitude, altitude, speed, and heading of aircraft.
- Local time (determined by the UTC offset)—see "Setting the UTC Offset" on page 11.

To view GPS status:

1. Press the Menu button until GPS appears.

2. Press Scroll Up or Scroll Down until you see the desired GPS menu item.

The example below shows the (DGPS) Status item as 3D Diff (after pressing Scroll Down once).



Using e-Dif

e-Dif (extended-Differential) is a proprietary Hemisphere GNSS technology that provides precision guidance with accuracy similar to that achieved with a broadcast differential solution. e-Dif monitors the standard GPS signals over several minutes to generate an internal model consisting of differential corrections. These corrections are then applied to the GPS positions to improve its accuracy. Typically, e-Dif maintains less than a three-foot drift over 40 minutes in relation to the original reference point. However, pass-to-pass accuracy typically remains as accurate as if you were using a broadcast differential signal. For e-Dif to work correctly you must maintain lock on a minimum of four satellites.

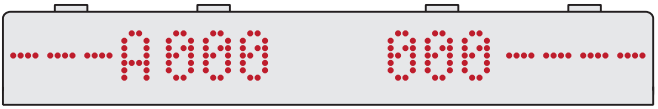
Because it does not use a broadcast differential signal, e-Dif can be used anywhere in the world. This makes e-Dif an ideal solution in areas where SBAS (WAAS, EGNOS, MSAS, etc.) is not available or is unreliable.

To use e-Dif:

1. Make sure e-Dif is the current differential corrections source (see “Selecting a Differential Corrections Source” on page 16).
2. Set the swath width and pattern type, set any other optional parameters, then press Enter. While LiteStar III tracks available satellites and sets an initial reference point, the lightbar displays the following:

   - ‘WaitGPS’ on the left
   - Differential age and satellite lock counter on the right

3. Once e-Dif is ready to use, you are prompted to set your A point.



4. Set your A, B, and (optional) C points for your pattern. After setting your last point (B for an open pattern; C for a closed pattern) LiteStar III switches to guidance mode.

Appendix: Additional Information

Frequently Asked Questions
Technical Specifications

Frequently Asked Questions

Q: My system will not power on when I flip the power switch ON.

A: When you power on the system the LiteStar III controller buttons have a blue illuminated border and the lightbar runs through the startup sequence (see “Powering On the LiteStar III” on page 4).

If there is no power to the system:

1. Verify there is power to the controller and controller fuse (see “Controller” on page 5).
2. Check the fuse.

⚠WARNING: Disconnect the power source from controller when checking the fuse.

---

   a. Remove the fuse from the controller and inspect the fuse for signs of over-current.
   b. b. Check for other fuse problems:
      – Aircraft battery state (common problem)
      – Aircraft-LiteStar III cable installation
      – Aircraft-LiteStar III grounding connections
      – Aircraft battery charging system components (such as alternator or regulator)
3. Check all wiring connections and terminal strips.

⚠WARNING: Avoid shorts to ground that may damage the controller.

Q: Why don’t I have guidance?

A: You may have lost differential GPS. Press the **Menu** button until GPS appears, then press **Scroll Up** or **Scroll Down** to display the following settings.

- Status: Will display ‘3D Diff’ when you are receiving DGPS corrections.
- Sats Trak: You need at least four satellites to obtain an accurate GPS position.
- Diff Age: If the differential age is zero, you are not receiving differential corrections.
- BitErr: Bit error rate (BER) represents the relative strength of the correction satellites. In the case of WAAS, two numbers are shown separated by a hyphen. Each number ranges from 0 (best) to 500 (worst). Typical causes for a reading of 500 are a poor connection between the console and antenna, no clear view of the sky, or a faulty antenna or receiver.

Q: How do I know which mode I am in?

A: If no LEDs are illuminated in the upper and lower bars, you are in setup mode. If there are upper or lower bar LEDs illuminated and all four display fields (Disp 1-4) show data, you are in guidance mode. See “Two Modes - Setup and Guidance” on page 7.

Q: How do I select a pattern?

A: Press the **Menu** button until Patrn appears, then press either **Scroll Up** or **Scroll Down** to select your pattern.

Q: I made a mistake entering my B point: Do I have to restart at point A?

A: If you have already set your B point, you must restart at point A by starting a new job and pattern.

Q: What is crosstrack distance?

A: Crosstrack (X-Track) is the perpendicular distance from your swath line. You can use the Disp 1 field or Disp 4 field to display your crosstrack distance (Disp 4 shows crosstrack by default)—you cannot display crosstrack distance in the Disp 2 and Disp 3 fields.

Q: How does the weather affect the GPS signal?

A: Weather such as rain, sleet, snow, thunderstorms, and wind normally does not affect the GPS signal.

Q: How do I change my swath width?

A: You can only set your swath width when you start a new job. Upon selecting a new job, LiteStar III first displays the SWidth field. You can accept the current value or select a different value.

Q: I've just finished spraying my field. How do I save my work? How do I start a new job?

A: LiteStar III automatically saves data associated with each job., including the total sprayed acreage and any mark you entered during the job.

Q: Should my spray be turned on or off when creating the A|B line?

A: That depends. You can create your A|B line inside or outside of the field to meet your needs. If you create the A|B line outside of your field, you will want your spray turned off.

The most common scenario, however, is to create the A|B line with the spray turned on when you fly your first swath.

Q: My field is not an even width. How will this affect my swath guidance?

A: Most fields will not be exactly divisible by your selected swath width. Typically, you will have a portion of a swath remaining when flying a closed pattern. LiteStar III will provide guidance to the next highest swath number—you may want to ignore this guidance and make a visual pass to spray the remainder of the field.

Technical Specifications

Table A-1 and Table A-2 list the technical specifications of the LiteStar III. Specifications are subject to change without notice.

Table A-1: Power specifications

Item	Specification
Voltage input range	10 - 32 V
Power consumption	12 W maximum
Current consumption	0.9 A maximum @ 12 VDC 0.5 A maximum @ 24 VDC

Table A-2: Mechanical specifications

Item	Specification
Lightbar	
Dimensions	2.53 H x 14.60 W x 5.94 D (in) 64 H x 370 W x 150 D (mm)
Weight	4.25 lb (1.92 kg)
Controller	
Dimensions	3.0 H x 5.75 W x 2.482 D (in) 76.2 H x 146.05 W x 63.03 D (mm)
Weight	1 lb (0.45 kg)
Complete Cable Set	
Weight	3.55 lb (1.61 kg)

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10. **WARRANTY DISCLAIMER.** EXCEPT AS EXPRESSLY SET OUT IN THIS AGREEMENT, AGJUNCTION MAKES NO REPRESENTATION, WARRANTY OR CONDITION OF ANY KIND TO LICENSEE, WHETHER VERBAL OR WRITTEN AND HEREBY DISCLAIMS ALL REPRESENTATIONS, WARRANTIES AND CONDITIONS OF ANY KIND INCLUDING FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, ACCURACY, RELIABILITY OR THAT THE USE OF THE SOFTWARE WILL BE UNINTERRUPTED OR ERROR-FREE AND HEREBY DISCLAIMS ALL REPRESENTATIONS, WARRANTIES AND CONDITIONS ARISING AS A RESULT OF CUSTOM, USAGE OR TRADE AND THOSE ARISING UNDER STATUTE.
11. **LIMITS ON WARRANTY DISCLAIMER.** Some jurisdictions do not allow the exclusion of implied warranties or conditions, so some of the above exclusions may not apply to Licensee. In that case, any implied warranties or conditions which would then otherwise arise will be limited in duration to ninety (90) days from the date of the license of the Software or the purchase of the Product. The warranties given herein give Licensee specific legal rights and Licensee may have other rights which may vary from jurisdiction to jurisdiction.
12. **CHANGE TO WARRANTY.** No employee or agent of AgJunction is authorized to change the warranty provided or the limitation or disclaimer of warranty provisions. All such changes will only be effective if pursuant to a separate agreement signed by senior officers of the respective parties.
13. **WARRANTY CLAIM.** In the event Licensee has a warranty claim Licensee must first check for and install all Updates that are made available. The warranty will not otherwise be honored. Proof of purchase may be required. AgJunction does not honor claims asserted after the end of the Warranty Period.
14. **LICENSEE REMEDIES.** In all cases which involve a failure of the Software to conform in any material respect to the documentation during the Warranty Period or a breach of a warranty, AgJunction's sole obligation and liability, and Licensee's sole and exclusive remedy, is for AgJunction, at AgJunction's option, to (a) repair the Software, (b) replace the Software with software conforming to the documentation, or (c) if AgJunction is unable, on a reasonable commercial basis, to repair the Software or to replace the Software with conforming software within ninety (90) days, to terminate this Agreement and thereafter Licensee shall cease using the Software. AgJunction will also issue a refund for the price paid by Licensee less an amount on account of amortization, calculated on a straight-line basis over a deemed useful life of three (3) years.
15. LIMITATION OF LIABILITY. IN NO EVENT WILL AGJUNCTION BE LIABLE TO LICENSEE FOR ANY INCIDENTAL, CONSEQUENTIAL, SPECIAL OR INDIRECT DAMAGES INCLUDING ARISING IN RELATION TO ANY LOSS OF DATA, INCOME, REVENUE, GOODWILL OR ANTICIPATED SAVINGS EVEN IF AGJUNCTION HAS BEEN INFORMED OF THE POSSIBILITY OF SUCH LOSS OR DAMAGE. FURTHER, IN NO EVENT WILL AGJUNCTION'S TOTAL CUMULATIVE LIABILITY HEREUNDER, FROM ALL CAUSES OF ACTION OF ANY KIND, EXCEED THE TOTAL AMOUNT PAID BY LICENSEE TO AGJUNCTION TO PURCHASE THE PRODUCT. THIS LIMITATION AND EXCLUSION APPLIES IRRESPECTIVE OF THE CAUSE OF ACTION, INCLUDING BUT NOT LIMITED TO BREACH OF CONTRACT, NEGLIGENCE, STRICT LIABILITY, TORT, BREACH OF WARRANTY, MISREPRESENTATION OR ANY OTHER LEGAL THEORY AND WILL SURVIVE A FUNDAMENTAL BREACH.
16. LIMITS ON LIMITATION OF LIABILITY. Some jurisdictions do not allow for the limitation or exclusion of liability for incidental or consequential damages, so the above limitation or exclusion may not apply to Licensee and Licensee may also have other legal rights which may vary from jurisdiction to jurisdiction.
17. BASIS OF BARGAIN. Licensee agrees and acknowledges that AgJunction has set its prices and the parties have entered into this Agreement in reliance on the limited warranties, warranty disclaimers and limitations of liability set forth herein, that the same reflect an agreed-to allocation of risk between the parties (including the risk that a remedy may fail of its essential purpose and cause consequential loss), and that the same forms an essential basis of the bargain between the parties. Licensee agrees and acknowledges that AgJunction would not have been able to sell the Product at the amount charged on an economic basis without such limitations.
18. PROPRIETARY RIGHTS INDEMNITY. AgJunction shall indemnify, defend and hold harmless Licensee from and against any and all actions, claims, demands, proceedings, liabilities, direct damages, judgments, settlements, fines, penalties, costs and expenses, including royalties and attorneys' fees and related costs, in connection with or arising out of any actual infringement of any third party patent, copyright or other intellectual property right by the Software or by its use, in accordance with this Agreement and documentation, PROVIDED THAT: (a) AgJunction has the right to assume full control over any action, claim, demand or proceeding, (b) Licensee shall promptly notify AgJunction of any such action, claim, demand, or proceeding, and (c) Licensee shall give AgJunction such reasonable assistance and tangible material as is reasonably available to Licensee for the defense of the action, claim, demand or proceeding. Licensee shall not settle or compromise any of same for which AgJunction has agreed to assume responsibility without AgJunction's prior written consent. Licensee may, at its sole cost and expense, retain separate counsel from the counsel utilized or retained by AgJunction.
19. INFRINGEMENT. If use of the Software may be enjoined due to a claim of infringement by a third party then, at its sole discretion and expense, AgJunction may do one of the following: (a) negotiate a license or other agreement so that the Product is no longer subject to such a potential claim, (b) modify the Product so that it becomes non-infringing, provided such modification can be accomplished without materially affecting the performance and functionality of the Product, (c) replace the Software, or the Product, with non-infringing software, or product, of equal or better performance and quality, or (d) if none of the foregoing can be done on a commercially reasonable basis, terminate this license and Licensee shall stop using the Product and AgJunction shall refund the price paid by Licensee less an amount on account of amortization, calculated on a straight-line basis over a deemed useful life of three (3) years.

    The foregoing sets out the entire liability of AgJunction and the sole obligations of AgJunction to Licensee in respect of any claim that the Software or its use infringes any third party rights.

20. INDEMNIFICATION. Except in relation to an infringement action, Licensee shall indemnify and hold AgJunction harmless from any and all claims, damages, losses, liabilities, costs and expenses (including reasonable fees of lawyers and other professionals) arising out of or in connection with Licensee's use of the Product, whether direct or indirect, including without limiting the foregoing, loss of data, loss of profit or business interruption.

21. TERMINATION. Licensee may terminate this Agreement at any time without cause. AgJunction may terminate this Agreement on 30 days notice to Licensee if Licensee fails to materially comply with each provision of this Agreement unless such default is cured within the 30 days. Any such termination by a party shall be in addition to and without prejudice to such rights and remedies as may be available, including injunction and other equitable remedies. Upon receipt by Licensee of written notice of termination from AgJunction or termination by Licensee, Licensee shall at the end of any notice period (a) cease using the Software; and (b) return to AgJunction (or destroy and provide a certificate of a Senior Officer attesting to such destruction) the Software and all related material and any magnetic or optical media provided to Licensee. The provisions of Sections 6), 7), 8), 9), 10), 15), 21), 26) and 27) herein shall survive the expiration or termination of this Agreement for any reason.

22. **EXPORT RESTRICTIONS**. Licensee agrees that Licensee will comply with all export control legislation of Canada, the United States, Australia and any other applicable country's laws and regulations, whether under the Arms Export Control Act, the International Traffic in Arms Regulations, the Export Administration Regulations, the regulations of the United States Departments of Commerce, State, and Treasury, or otherwise as well as the export control legislation of all other countries.

23. **PRODUCT COMPONENTS.** The Product may contain third party components. Those third party components may be subject to additional terms and conditions. Licensee is required to agree to those terms and conditions in order to use the Product.

24. **FORCE MAJEURE EVENT.** Neither party will have the right to claim damages as a result of the other's inability to perform or any delay in performance due to unforeseeable circumstances beyond its reasonable control, such as labor disputes, strikes, lockouts, war, riot, insurrection, epidemic, Internet virus attack, Internet failure, supplier failure, act of God, or governmental action not the fault of the non-performing party.

25. **FORUM FOR DISPUTES**. The parties agree that the courts located in the State of Kansas and the courts of appeal there from will have exclusive jurisdiction to resolve any disputes between Licensee and AgJunction concerning this Agreement or Licensee's use or inability to use the Software and the parties hereby irrevocably agree to attorn to the jurisdiction of those courts. Notwithstanding the foregoing, either party may apply to any court of competent jurisdiction for injunctive relief.

26. **APPLICABLE LAW**. This Agreement shall be governed by the laws of the State of Kansas, exclusive of any of its choice of law and conflicts of law jurisprudence.

27. **CISG.** The United Nations Convention on Contracts for the International Sale of Goods will not apply to this Agreement or any transaction hereunder.

28. **GENERAL.** This is the entire agreement between Licensee and AgJunction relating to the Product and Licensee's use of the same, and supersedes all prior, collateral or contemporaneous oral or written representations, warranties or agreements regarding the same. No amendment to or modification of this Agreement will be binding unless in writing and signed by duly authorized representatives of the parties. Any and all terms and conditions set out in any correspondence between the parties or set out in a purchase order which are different from or in addition to the terms and conditions set forth herein, shall have no application and no written notice of same shall be required. In the event that one or more of the provisions of this Agreement is found to be illegal or unenforceable, this Agreement shall not be rendered inoperative but the remaining provisions shall continue in full force and effect.

Warranty Notice

COVERED PRODUCTS: This warranty covers all products manufactured by AgJunction, Inc. (**"AgJunction"**) and purchased by the end purchaser (the **"Products"**), unless otherwise specifically and expressly agreed in writing by AgJunction.

LIMITED WARRANTY: AgJunction, Inc. warrants solely to the end purchaser of the Products, subject to the exclusions and procedures set forth below, that the Products sold to such end purchaser and its internal components shall be free, under normal use and maintenance, from defects in materials, and workmanship and will substantially conform to AgJunction's applicable specifications for the Product, for a period of 12 months from delivery of such Product to such end purchaser (the **"Warranty Period"**). Repairs and replacement components for the Products are warranted, subject to the exclusions and procedures set forth below, to be free, under normal use and maintenance, from defects in material and workmanship, and will substantially conform to AgJunction's applicable specifications for the Product, for 90 days from performance or delivery, or for the balance of the original Warranty Period, whichever is greater.

EXCLUSION OF ALL OTHER WARRANTIES. The LIMITED WARRANTY shall apply only if the Product is properly and correctly installed, configured, interfaced, maintained, stored, and operated in accordance with AgJunction's relevant User's Manual and Specifications, AND the Product is not modified or misused. The Product is provided "AS IS" and the implied warranties of MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE and ALL OTHER WARRANTIES, express, implied or arising by statute, by course of dealing or by trade usage, in connection with the design, sale, installation, service or use of any products or any component thereof, are EXCLUDED from this transaction and shall not apply to the Product. The LIMITED WARRANTY is IN LIEU OF any other warranty, express or implied, including but not limited to, any warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE, title, and non-infringement.

LIMITATION OF REMEDIES. The purchaser's EXCLUSIVE REMEDY against AgJunction shall be, at AgJunction's option, the repair or replacement of any defective Product or components thereof. The purchaser shall notify AgJunction or an AgJunction approved service center immediately of any defect. Repairs shall be made through an AgJunction approved service center only. Repair, modification or service of AgJunction products by any party other than an AgJunction approved service center shall render this warranty null and void. The remedy in this paragraph shall only be applied in the event that the Product is properly and correctly installed, configured, interfaced, maintained, stored, and operated in accordance with AgJunction's relevant User's Manual and Specifications, AND the Product is not modified or misused. NO OTHER REMEDY (INCLUDING, BUT NOT LIMITED TO, SPECIAL, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR CONTINGENT DAMAGES FOR LOST PROFITS, LOST SALES, INJURY TO PERSON OR PROPERTY, OR ANY OTHER INCIDENTAL OR CONSEQUENTIAL LOSS) SHALL BE AVAILABLE TO PURCHASER, even if AgJunction has been advised of the possibility of such damages. Without limiting the foregoing, AgJunction shall not be liable for any damages of any kind resulting from installation, use, quality, performance or accuracy of any Product.

AGJUNCTION IS NOT RESPONSIBLE FOR PURCHASER'S NEGLIGENCE OR UNAUTHORIZED USES OF THE PRODUCT. IN NO EVENT SHALL AGJUNCTION BE IN ANY WAY RESPONSIBLE FOR ANY DAMAGES RESULTING FROM PURCHASER'S OWN NEGLIGENCE, OR FROM OPERATION OF THE PRODUCT IN ANY WAY OTHER THAN AS SPECIFIED IN AGJUNCTION'S RELEVANT USER'S MANUAL AND SPECIFICATIONS. AgJunction is NOT RESPONSIBLE for defects or performance problems resulting from (1) misuse, abuse, improper installation, neglect of Product; (2) the utilization of the Product with hardware or software products, information, data, systems, interfaces or devices not made, supplied or specified by AgJunction; (3) the operation of the Product under any specification other than, or in addition to, the specifications set forth in AgJunction's relevant User's Manual and Specifications; (4) damage caused by accident or natural events, such as lightning (or other electrical discharge) or fresh/salt water immersion of Product; (5) damage occurring in transit; (6) normal wear and tear; or (7) the operation or failure of operation of any satellite-based positioning system or differential correction service; or the availability or performance of any satellite-based positioning signal or differential correction signal.

THE PURCHASER IS RESPONSIBLE FOR OPERATING THE VEHICLE SAFELY. The purchaser is solely responsible for the safe operation of the vehicle used in connection with the Product, and for maintaining proper system control settings. UNSAFE DRIVING OR SYSTEM CONTROL SETTINGS CAN RESULT IN PROPERTY DAMAGE, INJURY, OR DEATH. The purchaser is solely responsible for his/her safety and for the safety of others. The purchaser is solely responsible for maintaining control of the automated steering system at all times. THE PURCHASER IS SOLELY RESPONSIBLE FOR ENSURING THE PRODUCT IS PROPERLY AND CORRECTLY INSTALLED, CONFIGURED, INTERFACED, MAINTAINED, STORED, AND OPERATED IN ACCORDANCE WITH AGJUNCTION'S RELEVANT USER'S MANUAL AND SPECIFICATIONS. AgJunction does not warrant or guarantee the positioning and navigation precision or accuracy obtained when using Products. Products are not intended for primary navigation or for use in safety of life applications. The potential accuracy of Products as stated in AgJunction literature and/or Product specifications serves to provide only an estimate of achievable accuracy based on performance specifications provided by the satellite service operator (i.e. US Department of Defense in the case of GPS) and differential correction service provider. AgJunction reserves the right to modify Products without any obligation to notify, supply or install any improvements or alterations to existing Products.

GOVERNING LAW. This agreement and any disputes relating to, concerning or based upon the Product shall be governed by and interpreted in accordance with the laws of the State of Kansas.

OBTAINING WARRANTY SERVICE. In order to obtain warranty service, the end purchaser must bring the Product to an AgJunction approved service center along with the end purchaser's proof of purchase. AgJunction does not warrant claims asserted after the end of the warranty period. For any questions regarding warranty service or to obtain information regarding the location of an AgJunction approved service center, contact AgJunction at the following address:

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